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Brief report

The duration of light treatment and therapy outcome in seasonal affective disorder

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ABSTRACT

Background: Seasonal affective disorder (SAD) is characterized by recurrent episodes of major depression with a seasonal pattern, treated with light therapy (LT). Duration of light therapy differs. This study investigates retrospectively whether a single week of LT is as effective as two weeks, whether males and females respond differently, and whether there is an effect of expectations as assessed before treatment.
Methods: 83 women, and 25 men received either one-week ($n=42$) or two weeks ($n=66$) of LT were included in three studies. Before LT, patients' expectations on therapy response were assessed.
Results: Depression severity was similar in both groups before treatment ($F(1,106)=0.19$ ns) and decreased significantly during treatment (main effect "time" $F(2,105)=176.7$, $p<0.001$). The speed of therapy response differs significantly in treatment duration, in favor of 1 week ($F(2,105)=3.2$, $p=0.046$). A significant positive correlation between expectations and therapy response was found in women ($\rho=0.243$, $p=0.027$) and not in men ($\rho=-0.154$, ns). When expectation was added as a covariate in the repeated-measures analysis it shows a positive effect of the level of expectation on the speed of therapy response ($F(2,104)=4.1$, $p=0.018$).
Limitations: A limitation is the retrospective design.
Conclusions: There is no difference between 1 and 2 weeks of LT in overall therapy outcome, but the speed of therapy response differed between 1 week LT and 2 weeks LT. Together with the significant correlation between expectations and therapy response in women, we hypothesize that expectations play a role in the speed of therapy response.

1. Introduction

Seasonal affective disorder (SAD) is a mood disorder characterized by recurrent episodes of major depression with a seasonal pattern (Rosenthal et al., 1984). SAD has a prevalence of 2–10% in Europe and North America (Mersch et al., 1999). Light therapy (LT) is the treatment of first choice for winter type SAD in the The Netherlands (Spijker et al., 2013). The effectiveness of LT is well established; response rates are high with minor adverse events (Golden et al., 2005; Lam et al., 2006). However, there is no consensus on the duration of treatment required to be effective; treatment duration ranges from 3 days to 8 weeks (Eastman et al., 1998; Lam et al., 2006; Meesters et al., 1994; Terman and Terman, 2005). Levitt and Levitan indicate that a shorter duration of LT (2 weeks) can be as effective as a longer duration (5 weeks), suggesting a faster response rate in the group receiving shorter LT duration (Levitt and Levitan, 2003). Prior to the observed faster response, the expectations of the two patient groups regarding the speed of the response might have differed and this difference might have played a role in the faster response rate in the group that received 2 weeks of LT. This fits with previous findings that a positive expectation about response rate at the start of a therapy is related to therapy outcome (Eastman, 1990). Since there are indications outside the field of light treatment that expectations may differ between men and women, we included sex as an independent parameter into our analysis (Robinson et al., 2001).

In a database of studies with either 1 week or 2 weeks of light therapy we retrospectively analyzed the relationship between expectations of patients on therapy response with therapy response itself and the relationship with treatment duration and also to sex differences in expectations related to outcome.

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2. Material and methods

2.1. Study design and participants

For the current analysis we combined data obtained from three different studies, performed over a time span of 7 years (2005–2011). The studies were all performed in the SAD outpatient clinic of the University Medical Center Groningen (UMCG), The Netherlands. In two studies patients were treated with 2 weeks of light therapy (LT), in one study patients were treated with 1 week of LT. Patients received LT on five workdays each week. The choices for either 2 weeks or 1 week of treatment were made prior to the start of the separate studies, hence the choice between one week or two weeks of LT was made based on the research protocol of that specific study.

The first study compared blue-enriched light (for either 30 or 20 min) to standard full spectrum (30 min) over a period of two weeks (Gordijn et al., 2012). The second study compared low-intensity blue-enriched light to standard light treatment over a period of two weeks (Meesters et al., 2011). The third study compared low-intensity narrow band blue light to standard light treatment over a period of one week (Meesters and Duijzer, 2011). For specifications of the different light treatments see Table 1.

A total number of 120 patient cases were retrospectively selected based on the following criteria: all subjects met the criteria of Major Depressive Disorder with a seasonal (winter) pattern according to the DSM-IV-TR and did not suffer from other DSM-IV classified psychiatric disorders as assessed by the Mini-International Neuropsychiatric Interview (American Psychiatric Association, 2000; Sheehan et al., 1998). Patients who did not fill out all questionnaires were excluded ($n=12$). The remaining group of 108 subjects consisted of 83 women and 25 men, mean age ± SD 37.6 ± 12 years.

2.2. Procedures

The Structured Interview Guide for the Hamilton Depression Rating Scale-Seasonal Affective Disorder 24 items version (SIGH-SAD) (Williams et al., 1988) was used to assess severity of depression.

SIGH-SAD ratings were obtained prior to the start of LT, immediately after the last LT day, 1 week after the last LT day and for the two-weeks protocol also halfway the LT period. These studies measured depression score one week after the last LT session as depression score tend to decrease even after the end of treatment.(Meesters, 1995) Proportional improvement scores on the SIGH-SAD were calculated for both conditions.

In all three studies no significant differences between light conditions were observed (see for more details the relevant papers (Gordijn et al., 2012; Meesters and Duijzer, 2011; Meesters et al., 2011)): study 1, main effect "condition" $F(2,49)=0.73$ ns; study 2, main effect "condition" $F(1,20)=0.012$ ns; study 3, 67% recovery for standard treatment and 63% recovery for experimental treatment, ns. For the current analysis we pooled the data of all three studies and all different light conditions.

At baseline, patients filled out a questionnaire about their expectations, consisting of three questions: whether patients believed they would benefit from the therapy, if they thought it was a suitable treatment and whether they would recommend it to a friend with SAD. Answers were given on a 5-point Likert scale. These questions were asked for both the standard treatment and for the experimental treatment (the minimum score was 3 and the maximum score was 15). Significant differences were found between expectations ratings of the different types of treatment (expectation score ± SD; standard treatment: 10.9 ± 2.2, experimental treatment: 10.1 ± 2.5, $p<0.05$). We decided to use the expectation ratings in accordance to the type of light patients received, as we want to link the therapy expectations to the therapy they received.

2.3. Statistical analysis

Two groups with either one or two weeks of light therapy duration were compared with Chi-square for dichotomous variables 'group' and 'sex'. One-Way ANOVA was used to test for differences in age or baseline depression score between the two groups. SIGH-SAD results were compared with repeated measures ANOVA. Within-subject factor was the depression severity score on timepoints D1, D8 and D15, between-subjects was 'group' (1 week or 2 weeks LT) and covariate was the rating they gave concerning their expectations of the treatment. Final depression scores were calculated by the proportional difference between D1 and the last time point (D15 for 1-week LT and D22 for 2-weeks LT). All correlations were analyzed using Spearman (rank) correlation statistics; expectation scores are correlated to percentage depression score reduction.

3. Results

There were no differences in demographics between the two groups (one-week LT and two-weeks LT) (Table 1). Not in sex ratio (f/m 9/33, 16/50, $\chi^2=0.114$ ns), nor in age (mean ± SD, 37.3 ± 13.1 y; 37.7 ± 11.6 y, $F(1,106)=0.027$ ns), and not in baseline

Table 1
Characteristics of patients, light treatment and results.

		Study		
		Study 1	Study 2	Study 3
Participants		**52**	**14**	**42**
Therapy duration		**2 weeks**	**2 weeks**	**1 week**
Sex *n* (%)	**Male**	**13 (25)**	**3 (21)**	**9 (21)**
	Female	**39 (75)**	**11 (79)**	**33 (79)**
Age mean (± SD)		**37.6 (± 11.4)**	**38.4 (± 12.6)**	**37.3 (± 13.1)**
Baseline SIGH-SAD score (mean ± SD)		**26 ± 6**	**24 ± 8**	**25 ± 5**
Proportional reduction SIGH-SAD score (mean ± ± SD)		**66.3 ± 34.4**	**61.2 ± 28**	**70.2 ± 25**
Expectation (mean ± SD)		**9.2 ± 2.1**	**12.2 ± 1.1**	**11.3 ± 2.7**
MEQ (mean ± SD)		**52 ± 11**	**52 ± 8**	**51 ± 3**
Light specification*	**Standard**	**5000 °K (10000 lx)**	**5000 °K (10000 lx)**	**5000 °K (10000 lx)**
	Experimental	**17000 K (10000 lx)**	**17000 K (750 lx)**	**LED Blue light 470 nm (100 lx)**
Years of study		**2005/2006**	**2008/2009**	**2010/2011**

* All light conditions except the LED Blue light condition: full spectrum light, without UV.

depression score (SIGH-SAD score; F(1,106)=0.19 ns).There was also no significant difference in the proportional reduction in SIGH-SAD score between the two groups; 70.2% ± 25.0; 65.2% ± 33.0, F(1,106)=0.71 ns.

3.1. Speed of therapy response

Depression score decreased significantly over time from day 1 to day 15 in both groups (1 and 2 weeks LT) (SIGH-SAD, main effect "time" F(2,105)=176.7, $p<0.001$). Although there is no significant difference in final therapy outcome (mean proportional reduction ± SD, 1 week LT; 70 ± 25, 2 week LT; 65 ± 33, $p>0.05$) between the conditions, there is a significant interaction effect of time and group (interaction effect "time∗group" F(2,105)=3.2, $p=0.046$). Patients in the 2 weeks LT group showed a slower decrease in depression score compared to patients in the 1 week LT group (Fig. 1).

3.2. Role of expectation and sex in therapy response

Expectation ratings did not differ significantly between males and females (expectation score ± SD; males, 10 ± 2.8, females, 10.5 ± 2.4 ns). Looking at the relationship between therapy outcome and expectations, no significant correlation was found in males (Spearman correlation, $\rho=-0.154$ ns), but a significant positive correlation was found in female subjects ($\rho=0.243$, $p=0.027$) (Fig. 2).

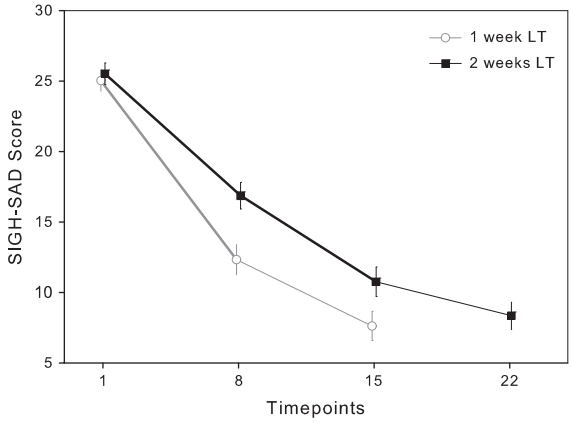

Fig. 1. Pattern of depression ratings over time for 1 week and 2 weeks separately.

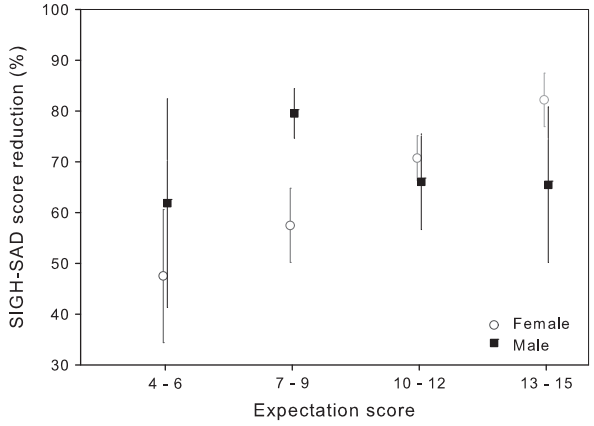

Fig. 2. Differences in expectations and therapy outcome in male subjects and female subjects. To make the graph visually understandable the expectation scores are divided in groups, where 4–6 is lowest and 13–15 is highest.

When added to the repeated measures statistics expectations were found to have a significant positive effect (interaction expectation∗time F(2,104)=4.0, $p=0.02$) and there still a significant effect of treatment duration was found (interaction group-∗time F(2,104)=4.1, $p=0.018$).

Adding sex as an interaction variable shows there is no significant effect between treatment duration and sex with expectation as a covariate (interaction group∗sex∗time F(2,102)=1.7, $p=0.18$).

4. Discussion

This study showed that there is no significant difference in final depression score between SAD patients receiving either one week or two weeks of LT in the setup of our clinical treatment. This could suggest that one week of LT is of sufficient duration for people with seasonal affective disorder. This conclusion is in line with results of earlier studies; studies in our own clinic show that early treatment, consisting of 5 days light treatment is able to prevent relapses for the entire winter (Meesters et al., 1993) and 1–2 weeks of light treatment is recommended by Partonen and Magnusson (Partonen and Magnusson, 2009). More studies comparing the effect of light treatment with different durations during different periods of the depressive episode may shed light on the question whether the speed of the effect and recovery differ depending on treatment timing in relation to the duration of the depressive episode.

Although there is no difference in the final depression score between one week of LT and two weeks of LT, there is a difference in the speed of the reduction of the depression score over time. Subjects with one week of LT have a faster decline in depression score compared to subjects with two weeks of LT. Similar to the experiment of Levitt and Levitan treatment duration was known to the subjects prior to the start, and it was told to be effective to treat the symptoms. This knowledge obviously resulted in the same overall expectation of the therapy response prior to the start, but might have induced the difference in the speed of the effect during the treatment. Patients with two weeks of LT expected that another week of LT was necessary, while the group that received one week of LT thought that one week was enough. Although the expectation could account for the slower decrease, other unknown factors may play a role as well.

Further analysis showed that it is only in women that the expectation on therapy response shows a relation with the actual therapy response. If a woman has a higher expectation of the therapy results, the therapy outcome will be better, while this effect is not shown in men. Taking expectations as a covariate in the speed of therapy response shows this has a significant effect. These results are in line with a study by Rutherford et al. in 2012 in which baseline expectation scores correlated with lower final depression severity score in patients with major depressive disorder (Rutherford et al., 2012). Outside the field of psychiatry Yee et al. in 2008 examined patient expectations before spinal surgery (Yee et al., 2008). They showed a significant positive correlation between patients' expectations and postoperative improvements in the physical domain.

Hypothesizing on a causal explanation of the correlation between expectations and therapy response is intriguing. Scott et al. showed in a functional MRI study that the basis of an expectation effect could be in the brain reward system (Scott et al., 2007). They linked the increased expectations of a monetary reward to increased dopamine release in the nucleus accumbens, a central component of the brain reward system.

4.1. Limitations

A limitation of this study is that it is a retrospective analysis; we combined data from separate studies to test a hypothesis the

studies were not designed for. These studies tested different types of light. Although within each study there were no significant differences found between the light conditions, the data remain confounded by these experiments and probably by other uncontrolled variables as year and weather conditions.

If confirmed in a prospective study, LT for SAD could be of a short duration and should be accompanied by the message that this short treatment duration is highly effective to retrieve the best result.

Role of funding source

For this study no funding was received. The corresponding author had full access to all data in the study and the final responsibility to submit it for publication.

Conflict of Interest

There are no conflicts of interests.

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